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How to increase interest in chemistry in High Schools and universities

Cómo aumentar el interés en la química en las escuelas secundarias y universidades

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ABSTRACT

Chemistry has become one of the most important disciplines in the school program and is very important in general education. Effective teaching is the basis for successful learning, so the purpose of this paper is to introduce current gaps and identify current pedagogical methods and technologies that are best used to teach in chemistry, improve teaching, increase interest in this field, and increase the level of teacher-student collaboration by thus creating an advanced shift in teaching methodology, from traditional to contemporary. It is conducted a quantitative study through which been observed some public and non-public high schools and some universities in Albania. Also, there were designed several questionnaires for teachers, pupils and students. In this study 20 high schools and 5 universities are included, are interviewed and have replenished the questionnaires about 200 pupils and students, 38 teachers and lecturers of different ages and at different times of experience as teachers. From the findings, it can be understood that the teaching process is set in a not very good situation. For people who are not passionate about teaching, such an attitude reflects on the way they learn and explain their subjects, and this has a negative impact on student performance. It is clear that the negative attitude of students towards chemistry is what often leads to the low performance we experience today. The study also found that time constraint is one of the main factors responsible, practical science does not develop, students are discouraged because they require proper attention, the number of hours given to chemistry in a week and the time allotted for each lesson, the impossibility of teachers to develop any significant practice within this timeframe are usually not sufficient for an effective chemistry lesson.

Keywords: Chemistry; Effective Teaching; Pedagogical Approaches; Contemporary Teaching

RESUMEN

La química se ha convertido en una de las disciplinas más importantes en el programa escolar y es muy importante en la educación general. La enseñanza eficaz es la base del éxito del aprendizaje, por lo que el propósito de este trabajo es introducir las lagunas actuales e identificar los métodos pedagógicos y las tecnologías actuales que se utilizan mejor para enseñar en química, mejorar la enseñanza, aumentar el interés en este campo e incrementar el nivel de colaboración entre profesor y estudiante, creando así un cambio avanzado en la metodología de la enseñanza, de lo tradicional a lo contemporáneo. Se realiza un estudio cuantitativo mediante el cual se han observado algunas escuelas secundarias públicas y no públicas y algunas universidades de Albania. Además, se diseñaron varios cuestionarios para profesores, alumnos y estudiantes. En este estudio se incluyen 20 escuelas secundarias y 5 universidades, se les entrevista y se han rellenado los cuestionarios a unos 200 alumnos y estudiantes, 38 profesores y conferenciantes de diferentes edades y en diferentes momentos de su experiencia como profesores. De los resultados se desprende que el proceso de enseñanza se sitúa en una situación no muy buena. Para las personas que no son apasionadas de la enseñanza, esa actitud se refleja en la forma en que aprenden y explican sus asignaturas, lo que tiene un efecto negativo en el rendimiento de los estudiantes. Está claro que la actitud negativa de los estudiantes hacia la química es lo que a menudo conduce al bajo rendimiento que experimentamos hoy en día. El estudio también encontró que la limitación de tiempo es uno de los principales factores responsables, la ciencia práctica no se desarrolla, los estudiantes se desalientan porque requieren una atención adecuada, el número de horas que se dedican a la química en una semana y el tiempo asignado para cada lección, la imposibilidad de los profesores de desarrollar cualquier práctica significativa dentro de este marco de tiempo no suele ser suficientes para una lección de química eficaz.

Palabras clave: Química; Enseñanza efectiva; Enfoques pedagógicos; Enseñanza contemporánea

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1. INTRODUCTION

Chemistry has become one of the most important disciplines in the school curriculum and is very importance in general education. Chemistry education is the study of teaching and learning chemistry in all schools, colleges and universities. Effective teaching is the basis for successful learning. Although Chemistry occupies a key position in our education system, student performance in this subject is still low. Naturally the question arises: Why do students have a weak interest in chemistry? What makes chemistry difficult and not very popular to learn from them? How can we increase their engagement and effectiveness in this subject? What methods should be practiced to improve pedagogical approaches and to attract pupils and students in a more entertaining way.

The purpose of this paper is to present the current gaps in the teaching of chemistry and to identify the current pedagogical methods and technologies that are best used to teach in chemistry, to improve teaching, to increase interest in this field and to increase the level of teacher-student cooperation thus creating an advanced change in teaching methodology, towards an effective teaching.

2. METHODS

This study was conducted through quantitative research through which several public and non-public high schools and some universities in Albania were observed. Several questionnaires and interviews were also designed for teachers, pupils and students. Most of the questionnaires were completed by physically visiting educational institutions, while teachers, professors or students who were not present completed them online through Google Forms. This study included 20 high schools and 5 universities, interviewed and completed questionnaires about 200 pupils and students, 38 teachers and lecturers of different ages and at different times of experience as teachers.

3. RESULTS

3.1 TEACHING IN CHEMISTRY

Chemistry education is the study of teaching and learning chemistry in all schools, colleges and universities. Topics include understanding how students learn chemistry, how to learn chemistry better, and how to improve learning outcomes by changing teaching methods. Teaching, especially that of Chemistry, is not an easy process, as an important social and with responsible activity. Art? Science? or both together? If teaching is an art, it requires inspiration, intuition, talent and creativity, and if it is science, teaching requires knowledge and skills. The best teaching is one in which objectives are met, student activated, interaction is encouraged, higher level questions are used, where the student is at the center of teaching. So teaching is a process that is planned, directed, organized by the teacher according to learning styles and with the active participation of students. The art of teaching is constantly evolving and progressing, making chemistry teachers reassess their teaching methods every year (Bani, 2020).

The purpose of this paper is to identify the current pedagogical methods and technologies that are best used to teach chemistry. Self-modern teaching designation means a teaching different from the traditional one. This is implicit in many aspects such as strategy (suitable in the learning process of pupils and students), methods, techniques, forms. While chemistry is part of our daily lives, students have found that chemistry can be difficult to understand, to learn, because it comes into play different types of thinking. To learn it successfully, we must be able to teach mathematical instruction, practical techniques, 3-D visualization, and history lessons. We need to teach students to be patient with the process of chemistry learning, it is part of the teaching work. If a pupils or student is found to be weak in this area, additional support should be provided to assist that student so that he or she can have an opportunity to realize his or her full potential. Teachers should help their students discover the ideas and concepts behind the pages they read. Not everyone can do this. There are many who can teach, but there are a few who can be called good teachers. Effective teachers are those who read, who are in constant contact with updates in their discipline and in teaching, and knowledge gained know how to apply them in the classroom. This is

not easy. This process goes through challenges, which, when passed, produce the desired learning. In this sense, the effectiveness of the learning hour knows no bounds. As it relates to social experience, academic background, level of development, desire for progress, it is also has to relate and has to conditione by the initial premise. This premise has two components that often influence one another: (1) the desire for the teaching profession and (2) the development and refinement of mastery. New teachers or professors are generally characterized by a desire for the profession (Bani, 2020; Avaa, 2007). Being at the beginning of their academic career, they are interested in learning the secrets of effective teaching as soon as possible. In fact, the teaching methods used in our lesson hours are limited. Many lesson hours are "boring". They are developed in a standard way and do not respond to the concrete situations in which learning takes place. It is therefore very important to increase the level of interest and improve the pedagogical approach, for a successful learning and improvement of the teaching process (Bani, 2020; Ojo, 1989; Usman, 2000).

3.2 EFFECTIVE TEACHING

To make chemistry teaching effective in high schools and universities, is needed a great of work and effort to identify gaps and problems. There are many factors that influence the effective teaching of chemistry, which plays a vital role in the lives of students thus affecting their performance. In these factors may include:

- Teaching rules
- Availability of laboratory equipment
- Availability of chemicals and materials
- Availability of laboratory staff
- Laboratory working conditions
- Security measures
- Recommended literature
- Physical classrooms, tables, chairs, boards, desks
- Clean environment
- Dissemination of information through library, seminars, workshops, etc.

It is noticed in almost all high schools and universities in Albania that laboratory equipment and materials are inadequate or incomplete. The integration of theory with practice is important for effective teaching. So all of this must be well organized so that pupils and students can increase assimilation and performance, especially by giving the laboratory and its activities a central role in chemistry education.The laboratory program is an important part and a very necessary tool for obtaining and learning scientific information. It also stimulates the interests of students and students to engage in useful scientific activities and experiments and to think through chemical concepts. At the same time the knowledge gained through the laboratory promotes a long-term memory in the science of chemistry. The teacher or lecturer can be considered as a catalyst or mediator by bringing about changes in student behavior. It has a basic role to make intentions, educational plans and survival of the education system current. The process of training chemistry teachers should also be given importance, as these programs enrich the skills to perform tasks and make the work more efficient, improve and support the teaching. These training activities can be designed by the educational institution or can be taken as an individual teacher's initiative. Frequent and continuous training of teachers and lecturers is the cornerstone in improvement, transformation in schools and professional development. Trainings can be in the form of workplace training, seminars, workshops, training courses, etc. These services create favorable environments to expose teachers to new

ideas and developments in their field of work. This helps professionals to maintain control in their skills and knowledge. So teachers need to be academically and professionally trained to have increased effectiveness and a positive impact on the education system (Bani, 2020).

3.2.1 BASIC PRINCIPLES FOR EFFECTIVE TEACHING

Many world organizations have provided advice and guidance to teachers on how can to improve the quality of teaching through the possibility for teachers to be trained, licensed or certified. Recent years in Albania also seem to be gaining importance through their development and application, as a tab They promote some principles that should be part of every teacher's practice (Bani, 2020; Raimi, 2002). They are summarized in Table 1.

Table 1. Teachers' Principles

Principle 1	The teacher understands the basic concepts, teaching tools, and discipline structures that he or she teaches and can create learning experiences that make these aspects of the subject meaningful for students.
Principle 2	The teacher understands how students learn and develop and can provide opportunities that support their intellectual, social, and personal development
Principle 3	The teacher understands how students differ in their learning approaches and creates learning opportunities that are adapted to different students
Principle 4	The teacher uses an understanding of individual and group motivation and behavior to create a learning environment that encourages positive social interaction, active learning engagement, and self-motivation
Principle 5	The teacher understands and uses a variety of teaching strategies to encourage the development of students' critical thinking, problem solving, and performance skills
Principle 6	The teacher plans lessons based on subject knowledge, students, community and curriculum goals
Principle 7	The teacher uses knowledge of effective verbal, nonverbal and media communication techniques to foster active learning, supportive collaboration, and interaction in the classroom
Principle 8	The teacher understands and uses formal and informal assessment strategies to ensure the ongoing intellectual, social and physical development of the student
Principle 9	The teacher is a reflective practitioner who constantly assesses the effects of his or her choices and actions on others (students, parents, and other professionals in the learning community) and who actively seeks opportunities to grown professionally
Principle 10	The teacher fosters relationships with school colleagues, parents, and community agencies to support learning and well-being

Source: (Bani, 2020; Raimi, 2002).

It is worth noting that very important, besides subject knowledges, in the teacher effectiveness also influence other factors such as table 2.

Table 2. Teacher effectiveness

Behavior in the classroom: A teacher's personality is a factor that predominates in student success within the teacher's influence. The way we behave and how we want to share our personality with students.
Orientation of work and students by transmitting happiness: Good teachers in the classroom are happy. They enjoy the emotions of discovery and the natural curiosity of the students. Students continually evaluate teachers when humor is part of the classroom environment. This humor comes not from telling many jokes, but from good conversations and discussions with students about chemistry teaching topics. Humor helps break down conversational barriers, builds good relationships, and builds strong classroom communities.
Classroom Management: The energy a teacher has for teaching a subject is as important as the knowledge he or she has for the subject. If we are passionate or less happy about teaching, students will be able to determine it very quickly.
Way of teaching and disseminating information: Effective teachers are curious and creative. They are all the time asking questions, seeking explanations, new opportunities, willing to experiment and try new approaches to learning. They are content not finding all the answers but developing a classroom environment where prevail questions from teacher to student, and from student to teacher.

Source: Source: (Bani, 2020; Raimi, 2002).

3.3 CONTEMPORARY TEACHING

Modern teaching is a teaching during which tends to have at the center the pupils or student. To realize this teaching, need to be planned the learning process and critical thinking. Contemporary teaching requires proper planning of the teaching material, teaching methodology and techniques used to achieve the learning objectives. The possibility of switching from traditional to contemporary schools results in both in terms of methodology and active student participation (where they are themselves in center) stimulating them to practical activities (mainly chemistry laboratory). So is cultivated their individuality, learning, mental skills are acquired not only from the texts but also from the experience.

The main purpose of education lies in the formation of creative people and not just to repeat what generations have discovered before. Chemistry science cannot be taken as a system in which knowledge is gathered and organized but as a source of problems, new ones, why-s, during which the teacher or lecturer encourages the pupils or students to discover it themselves. Also, it creates the opportunity for mutual teaching. The best way is to learn by teaching. So, teaching the science of chemistry is an institutionalized activity that takes place in the relevant specialized institutions, which are schools or universities (Angyaye, 2007; Onocha, 1985). A very important step is the preparation of teachers or pedagogues for the successful organization of chemistry teaching. The preparation of the lesson constitutes the special and general part. The special part includes daily preparation for each lesson, development of teaching material and preparation of exercises. The general part includes the teaching of the subject as a whole, the reading of professional literature. Chemistry lesson planning is conditioned by the definition of learning objectives, the choice of teaching procedures, the preparation of basic materials and auxiliary tools, the control and assessment of progress of pupils and students. Learning objectives describe the formation of learning. We can say that these are the elementary conditions for successful teaching and quality learning (Bani, 2020; Abdulahi, 1982; Abdullah, 2009; Abuseji, 2008).

3.4 WORK PROCEDURE

From the answers to the questionnaires and interviews it was found that:

1. Some teachers are in this profession not willingly, considering it as a waiting place for better jobs. *("I haven't gotten a better job yet, so I'm still here," said one teacher) or "I have been teaching for several years in a row but my heart is not here,"* said another teacher. These teachers do not have the passion to teach, so how can they do their best in a job they do not take seriously?

2. In the students' attitudes towards chemistry, some said that *"I learn chemistry because I need to get a grade at the end of the semester, it is difficult to understand, I do not have much time to deal with it or, the teacher does not create ease."*

3. An unprofessionalism was found, as give chemistry the teachers who did not graduate directly in chemistry *("I studied biotechnology", "I studied chemical engineering, electrical engineering" "I studied biology"* but *due to non-fulfillment of the teaching norm or of the claim to have an additional burden, give the subject of chemistry were expressed other teachers).*

4. Was found a time limit in high schools, having a busy schedule and little time (45 min) available which should be divided between asking students questions, explaining the new topic, taking absences and giving homework, as well as improper organization of the development schedule of the chemistry class in universities, the entire load of a week developed in 2 or 3 hours in a row, as it affected the non-concentration of students around a chapter.

5. When interviewed, the teachers had also participated in seminars or training courses related to the teaching of chemistry. *("I have not participated in any training since I started working in this job as the leader does not give me permission to attend, since they have been developed in official working hours")* as it were and such who had attended *("I attended and continue to attend seminars and open lectures related the teaching, and that has helped me fill in the gaps," said another).*

6. The size of groups of pupils or students as well as the size of the classroom were another impediment factor in the effectiveness of the teaching *("I have a class with an average of 96 students, I teach in 3 such classes, and this has a negative impact on my efficiency because firstly it is a problem the management of classroom, secondly I am not sure if each of the students is understanding me, I spend a lot of time checking the classroom considering the short teaching time and this affects the students' performances in their final exams," said one teacher).*

7. Service conditions were another factor that had a negative impact. "The claim that he could be more qualified than others in the staff made the teacher have a weak interest in the correctness and readiness of the students, *"Only I am maximally qualified and of course my workplace needs me",* said one of the teachers) while some students expressed: *("Why should I teach this subject in that institution with that teacher when it is very costly while I can choose something easier and less financially difficult").*

8. Laboratory suitability as a key of curiosity in chemistry was paramount. Many demonstrations are involved and is achieved an effective way for an easy access to teaching materials. Almost all schools (except for one non-public school which had a simple laboratory environment but with deficiencies of reagents and equipment, functioned only for simple chemical demonstrations) lacked laboratory facilities. In universities there were chemical laboratories, with some small deficiencies of reagents and the lack of support staff in this environment.

- From the findings it can be understood that the teaching process is set in a not very good situation. For people who are not passionate about teaching, such an attitude reflects on the way they learn and explain their subjects, and this has a negative impact on student performance.
- From the study it is clear that the negative attitude of students towards chemistry is what often leads to the low performance we experience today.
- The study also found that time constraint is one of the main factors responsible, practical science does not develop, students are discouraged because they require proper attention, the number of hours given to chemistry in a week and the time allotted for each lesson, the impossibility of teachers to develop any significant practice within this timeframe are usually not sufficient for an effective chemistry lesson.

4. CONCLUSIONS

Although Chemistry occupies a main position in our education system, the performance and interest of pupils and students, in this subject it is still low. Some of the reasons identified are:

- Laboratory inadequacy
- The behavior and attitude of the teacher or pedagogue
- Poor exam handling, time constraints and lack of practice
- Classroom conditions and environment
- Unprofessionalism

Taking into account the findings and conclusions drawn from this study, some recommendations can be made for effective teaching in chemistry such as:

- The laboratory must be equipped with essential equipment, such as water system, electricity, fire extinguishers.
- Teachers' academic experience and professional qualifications should be based on the required discipline, so in Chemistry.
- The direction of teaching of the pedagogue must match with the field of his specialization.
- The willingness and availability of the teacher to come to the aid of pupils or students regarding the ambiguities or shortcomings of the subject.

- Employing qualified people for the laboratory (laboratory technicians) in order to help teachers prepare laboratory practice (as this will make teacher work less difficult and effective teaching will be promoted).
- Providing relevant school materials or textbooks for both teachers and students.
- Obstruction by governmental educational authorities of trivial and low standard textbooks.
- Orientation of chemistry teaching methods, the curriculum for chemistry should be oriented properly and should not be overloaded.
- Organizing seminars to promote the effectiveness of the subject.

Strongly suggesting the use of:

Lecture: focusing on the current chapter, reviewing certain tasks, and presenting the connections of the subject to everyday life.

Visuality: projecting on the screen and showing how work today's trends. Drawing atoms and molecules, pass of electrons, etc.

Chemical demonstrations: to keep the class interest in the subject of chemistry it would be a good idea to carry out some small and simple experiments (a flame) and explain the possibility of their occurrence.

Practical experience: I believe that the cornerstone of a good chemistry class is definitely the lab work. Maintaining lecturing through important experiments as well as reasoning what is happening and why it is happening.

- In the end, and most importantly, be enthusiastic! Show enthusiasm for what you are explaining. If the pedagogue fails to maintain interest in the subject it is understandable that the student will give up.
- Unable to develop real labs, virtual ones are an effective way for chemistry teachers to engage their students with active learning.
- Chemistry videos will put students in a virtual world of complex molecules and equations.
- This is a great way for students to increase their potential and think as if they are working in a field.
- Their commitment is active when they see that concepts have been studied and applied in real life.
- The transition from "teaching with the teacher or pedagogue at the center" to " teaching with the pupils or student at the center" gives students the ability to learn and engage actively with each other without being dependent by the teacher.

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